Final Year Project Proposal Form

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| Programme | | MEng(Hons) Robotics Engineering |
| Module Code | | PROJ324 |
| Proposer | | **Self** / ~~Supervisor~~ / ~~Industry~~ |
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| Proposal Title | | Open-water Rubbish Collection robot with Automatic sensing (O.R.C.A) |
| **Objective:**  Create a surface-litter cleaning robot for still and slow-moving expanses of water such as, a canal, lake, or harbour. The objective of this project is to create a cleaner and safer environment on still bodies of water that typically collect large amounts of surface-dwelling litter. The robot will traverse its environment autonomously until it has filled its litter storage, or the battery is running flat, at which point it will return to a designated location to be collected and offload relevant telemetry data. | | |
| **Aim:**  Pollution has become an increasingly pressing issue especially in large bodies of water, such as harbours, canals, and lakes and reservoirs. It is difficult to remove litter from the surface of water for many reasons. The litter drifts around due to the currents and water flow in these bodies of water and usually requires someone to go into the body of water.  This project aims to provide a solution used to automate the collection of this litter from the surface of the water. This will be done using a form of boat/raft that will be able to traverse the environment safety and effectively and will be able to filter the litter from the water.  One of the main inspirations for this project is the WasteShark ([source](https://www.ranmarine.io/products/wasteshark/)) which is designed to remove floating pollution from the surface from lakes, ponds, waterways, and harbours. It removes plastics, algae, and biomass from the surface.  This project contains both software and hardware.  Hardware:   * The main body of the craft that will be collecting the litter * Suitable propulsion method for driving the craft around (ie. Propellors, Fans, Jets etc.). This will be important and will need to be considered for the type of environment that the craft will be going into. * Collection system for the rubbish to remove it from the surface of the water. * Make custom remote controllers that can communicate together to tell the operator important information about the craft   Software:   * Implement a suitable control system to allow movement of the craft and control the collection of the rubbish. * Automatically sense when the rubbish collection is full and alert the user accordingly. * A system to track the amount of rubbish collected along with other important types of information such as duration of task. * Suitable communication between the hose device and the controller, relaying data such as battery voltage, how full the storage container, time of current usage, speed. * Further extended deliverable – Implement machine vision to identify and track rubbish on the surface of the water and manoeuvre to it and automatically begin collecting rubbish.   The scope of this project has many different elements, and these can be split into different assessable levels.   1. Design and create a boat that is capable of floating on water and being driven around by a radio controller and receiver. The craft will need to be an appropriate size such that it can carry all the equipment on board as well as a decent payload of rubbish to be collected. I will need to create a suitable propulsion system, steering system, and make sure the craft is stable both at top speed and when cornering. It is important to make sure the craft is highly controllable and safe to operate. 2. Design and create a suitable litter collection system that can collect and sorting the litter on the surface of water. The system will need to be able to be turned off, not be damaging to wildlife, and be able to collect all types of litter that collect on the surface. 3. Combine the litter collection system with the main hull of the boat. Check that the functionality of both components is not impeded by the combination of the two parts together. Get the two parts of the boat controlled separately using a radio controller (as the radio controller that I have is only 3 channels). 4. Implement a custom microcontroller based remote control and receiver for the boat that would allow broader uses for the controller. The controller would be able to display some rudimentary values such as, battery charge on the boat, the current capacity of the rubbish collection system, and the status of the litter collection system (operating/not operating). 5. Add sensors, both active and passive, to help with rudimentary obstacle avoidance. The status would of these combined sensors would be outputted to the controller that would alert the user, alongside stopping the boat colliding with obstacles. 6. Add autonomous control to the boat that will allow it to run rudimentary route to autonomously collect litter. The boat would be able to be able to be run without significant human interaction and would return to its starting position when the litter collection mechanism is full. The boat would alert the user when the litter collection is full allowing it to be emptied, refilled, and sent out to collect more litter.   Successful tests of the system will be:   * The boat floats and can be controlled safely. * The boat can carry a sufficient payload to allow it to collect and store litter as it is being driven around. * The litter collection successfully collects litter and stores it without missing or dropping anything back into the water. * The litter collection system doesn’t cause any harm to the environment, unless it is collecting wildlife that is actively harming the environment, such as algal blooms that use up all the oxygen in the water at night and can cause suffocation of fish and other marine life. * The boat and litter system work together without impeding on their respective roles and functions. * The controller allows effective controlled movement of the craft as well as effective litter collection and takes accurate readings of the boat and litter collection. * The sensors on the boar are effective in avoiding collisions with both static and moving objects. This will protect the boat and anything it may encounter. * The boat can autonomously follow a path that allows it to collect litter and alert the user when the litter collection is full and ready to be emptied. | | |